

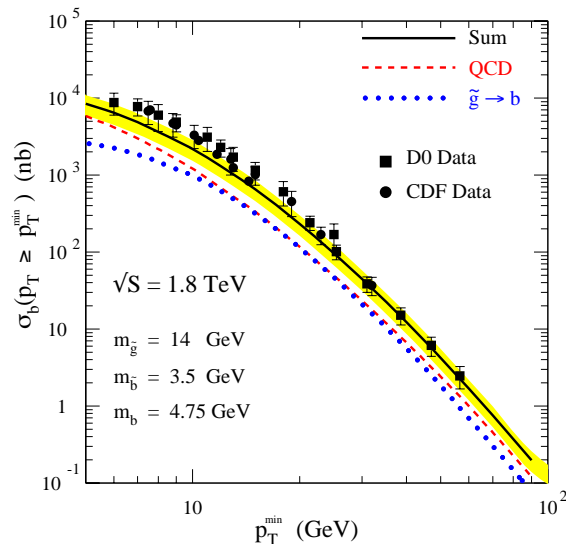
Thoughts on b-jet cross sections

- Excess in B-production well-known both at Tevatron and elsewhere

New physics in heavy quark production?

The discrepancy has been around long enough that a SUSY-based solution has been proposed: light gluino and bottom squark production [Berger, Harris, Kaplan, Sullivan, Tait, Wagner, PRL **86**, 4231 (2001)]

but like high E_T jets, check to see if it is *old physics* first

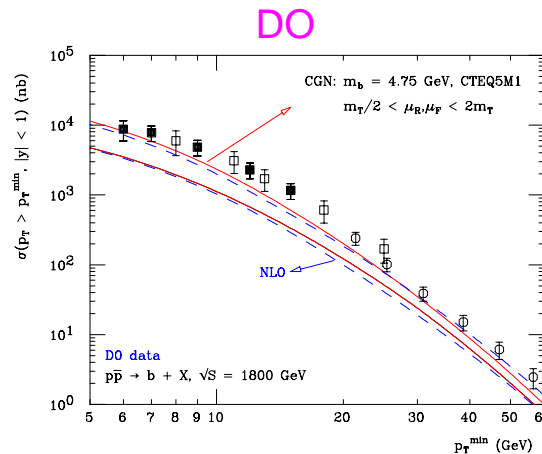
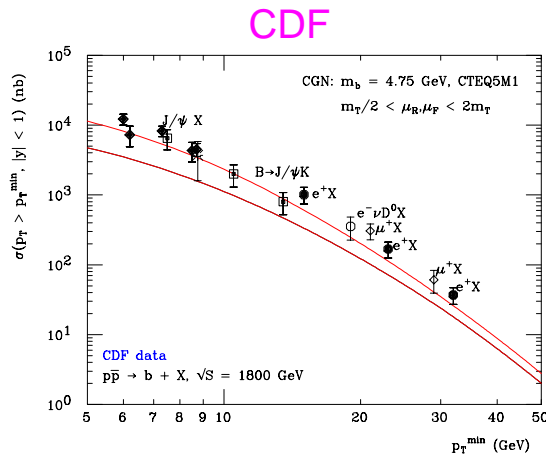


Production of light gluinos followed by their decay into bottom and bottom squark:

$$p\bar{p} \rightarrow \tilde{g}\tilde{g} \text{ and } \tilde{g} \rightarrow b\tilde{b}$$

Deviation is smaller with latest theory

b quarks @ Tevatron



Theory: MC, Greco, Nason [JHEP **05** (1998) 007] (full NLO + NLL collinear resummation)

Data from D0 and CDF fairly compatible. Within errors (both theoretical and experimental), borderline agreement with theory too.

NB: no parameter (mass, QCD coupling, scales, etc....) has been pushed to its limits in producing this plot).

Recent developments in heavy quark production by Cacciari, Nason and company: hep-ph/0203025 and cacciari.ps on qcd webpage

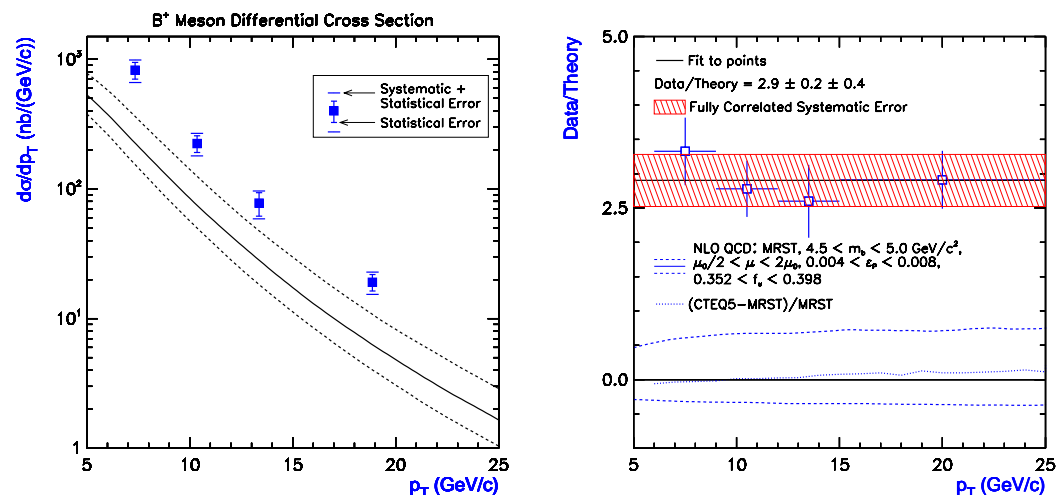
Full NLO+NLL (resum) + use of Mellin moments in determining b fragmentation

N.B.: Peterson fragmentation not appropriate for NLO description

B Meson production: old theory

CDF data: B mesons

(hep-ph/0111359)



$$\frac{d\sigma^B}{dp_T} = \frac{d\sigma^b}{dp_T} \otimes D^{b \rightarrow B}(z)$$

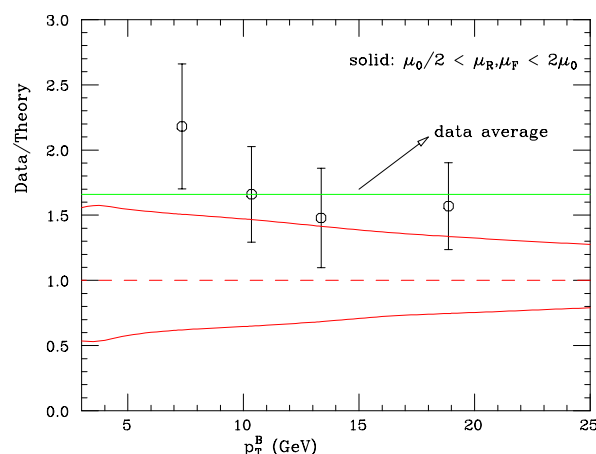
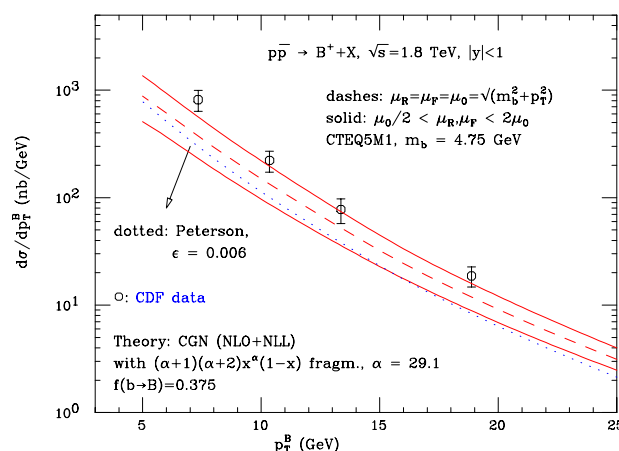
$$D^{b \rightarrow B}(z) = \text{Peterson et al. form, } \epsilon = 0.006$$

$$\text{Data/Theory} = 2.9 \pm 0.2 (\text{stat} \oplus \text{syst}_{p_T}) \pm 0.4 (\text{syst}_{\text{fc}})$$

After new theory

CDF data: B mesons

Updated plots:



- CGN **NLO + NLL** b quark spectrum instead of NLO
- non-perturbative fragmentation function determined from **moments space** e^+e^- data

$$\text{Data/Theory} \simeq 1.7 \pm 0.5 \text{ (expt.)} \pm 0.4 \text{ (theor.)}$$

(MC, P. Nason, to be published)

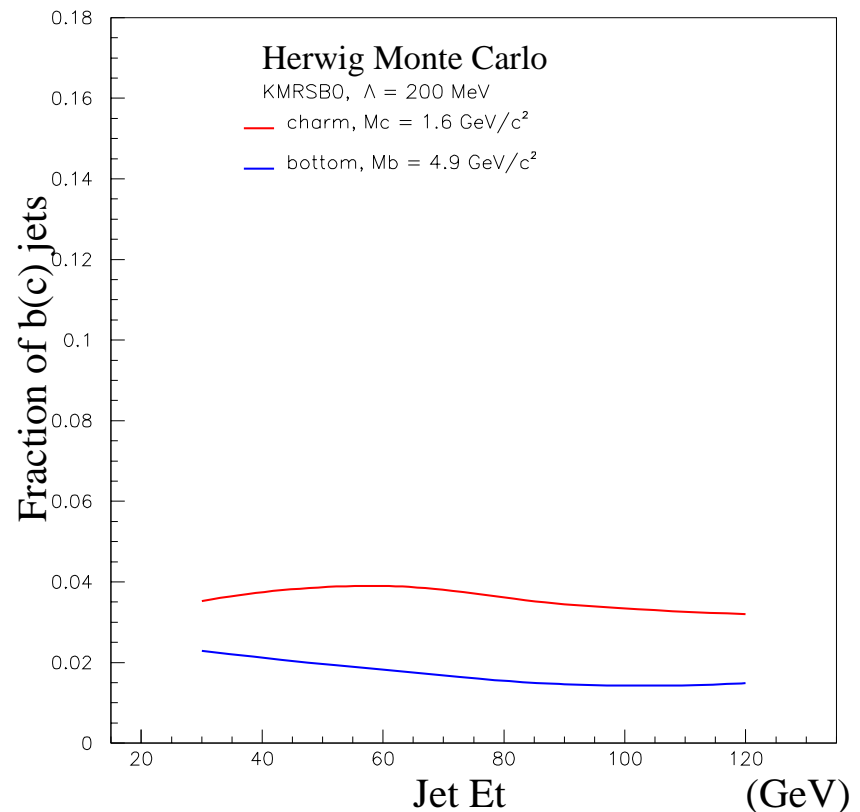
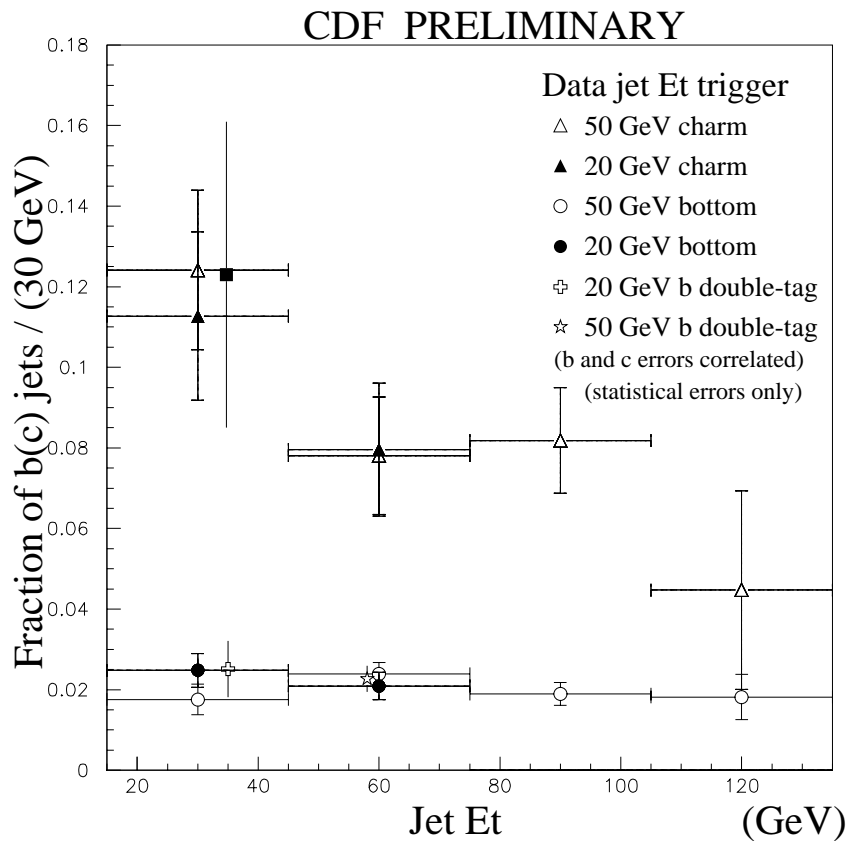
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b-jet cross sections

- So a great deal of the problem may have been with the fragmentation
- Seems reasonable to measure a b-jet cross section
- D0 has measured b-jet cross section in Run 1 using an inclusive muon-triggered sample

CDF Run 1 result: never published

- b reasonable; problem with charm?



J. Huston

b jet cross sections in Run 2

- Some naïve questions:
 - ◆ Can we use inclusive jet path(s) to measure inclusive b jet cross section and/or b jet fraction?
 - ▲ use secondary vertex as offline tag?
 - ▲ how low in E_T can we go?
 - ◆ How can SVT, lepton triggers, etc be used as well?
- Seems like a physics-worthy goal as well as a useful sample of b jets with a wide range of energies